Citation:

Thijssen MA, Hornstra G, Mensink RP. Stearic, oleic, and linoleic acids have comparable effects on markers of thrombotic tendency in healthy human subjects. *J Nutr.* 2005 Dec;135(12):2805-11.

PubMed ID: 16317124

Study Design:

Randomized Crossover Trial

Class:

A - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To compare the effects of stearic, oleic, and linoleic acids on platelet aggregation, coagulation, fibrinolysis, and hematological variables.

Inclusion Criteria:

- Healthy, nonsmoking adults who were slightly hypercholesterolemic
- Aged 28 - 66 years

Exclusion Criteria:

This article stated that the screening procedure and eligibility criteria were reported in a previous article, but in general, subjects had to be willing to follow research protocol, complete a food diary, and keep weekly appointments with a dietitian.

Description of Study Protocol:

Recruitment

None stated in this article. Information on recruitment and subject selection was published elsewhere.

Design - Randomized crossover trial

Blinding used (if applicable): none specifically described

Intervention (if applicable)

- Each participant consumed 3 different diets in random order over three 5-week periods
- After each intervention period, there was a washout period of at least 1 week when

participants consumed their habitual diets
- Three diets, each diet contained 7% of the energy from stearic acid, oleic acid, or linoleic acid.
- The diets contained about 35% energy from fat.

Statistical Analysis

- All data were analyzed with the general linear model procedure
- Differences in effects were examined with diet and period as fixed factors and subject number as random factor
- Between-diet comparisons were corrected for three-group comparisons by the Bonferroni correction, and 95% confidence intervals were calculated for differences among the diets

Data Collection Summary:

Timing of Measurements:

- At the end of each diet period, blood was drawn in week 4 and 5, after an overnight fast.
- The subjects were also weighed at the end of each diet period.

Dependent Variables

- Fatty acid composition of phospholipids
- Platelet aggregation
- Measurements of coagulation and fibrinolysis

Independent Variables

- 7% energy from stearic acid
- 7% energy from oleic acid
- 7% energy from linoleic acid

Control Variables

Description of Actual Data Sample:

Initial N: 45 subjects (18 males, 27 females)

Attrition (final N): assumed 45 subjects

Age: 28-66 years, mean 51 years

Ethnicity:

Other relevant demographics: none provided

Anthropometrics men had BMI's ranging from 21.8 to 29.8. The women had BMI's ranging from 18 to 29.4.

Location: Maastricht University, Maastricht, The Netherlands

Summary of Results:

Key Findings

- The 3 diets differed in their effects on the proportions of stearic, oleic, and linoleic acid. The proportions of arachidonic acid and DHA did not differ.
- The proportions of the n-3 PUFAs, alpha-linolenic acid, and EPA were lower during consumption of the linoleic acid diet compared with the other two diets.
- The number of erythrocytes was lower when subjects consumed the diet high in linoleic acid rather than the stearic acid diet.
- In men, ex vivo platelet aggregation time as measured by filtragometry ($P = 0.036$ for diet effects) was favorably prolonged during consumption of the linoleic acid diet compared with the stearic acid diet ($P = 0.040$), but there was no difference with consumption of the oleic acid diet ($P = 0.198$).
- In vitro platelet aggregation induced by collagen and ADP, and variables of coagulation and fibrinolysis did not differ between the diets.
- Hematocrit values were slightly lower in men consuming the linoleic acid diet compared with the diets high in stearic acid and oleic acid.
- When subjects consumed the stearic aid diet, the platelet volume decreased by 0.32 fL compared with the oleic acid diet ($P < 0.001$) and by 0.35 fL compared with the linoleic acid diet ($P < 0.001$).

Other Findings

- Body weights remained the same, irrespective of the diet followed.

Author Conclusion:

To summarize, when 7% of dietary energy of stearic acid was replaced by linoleic acid, ex vivo platelet aggregation was beneficially affected in men. Stearic acid consumption reduced platelet volume relative to the other two fatty acids. The effects on coagulation and fibrinolytic variables did not differ among the 3 fatty acids. Overall, therefore we conclude that our results do not provide evidence that stearic acid is highly thrombogenic, as suggested by some earlier studies.

Reviewer Comments:

Recruitment methods described elsewhere. Handling of withdrawals not described in this article. Supported by the Dutch Dairy Association.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes

3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	???
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A

3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	???
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	???
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	???
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	Yes
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	No
6.6.	Were extra or unplanned treatments described?	N/A

6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	No
10.	**Is bias due to study's funding or sponsorship unlikely?**	???

10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	???